

Response to the PCT Written Opinion

1) The following opinions were expressed in the Response dated November 22, 2004 issued by the PCT International Searching Authority.

A) Although the invention pertaining to claims 4 to 8 possesses novelty and inventive step, the invention pertaining to claims 1 to 3 lacks inventive step. As the reason for this, the Examiner is indicating that "since claim 3 and paragraph [0014] of Document 1 cited in the International Search Report describe the invention pertaining to claims 1 to 3, the invention pertaining to claims 1 to 3 lacks novelty and inventive step. Since the diffusion of Sn between a solder bump and a substrate layer or a pad is a matter unrelated to the target itself, this is not considered here."

B) The Examiner is further indicating that there is an inappropriate description which states that "the inhibition effect of Sn diffusion between a solder bump and a substrate layer or a pad is not the property of the target itself".

It has become clear that the lack of novelty and inventive step is because the inclusion of Ti in the present invention overlaps with Document 1. This has been amended to clarify the difference with Document 1. Further, the description of "inhibition effect of Sn diffusion" has been amended for clarification.

As a result of the foregoing amendments, the present invention possesses novelty and inventive step, and the inappropriate description has been corrected. The reasons for this are explained in detail below.

Incidentally, the cited documents are the following Documents 1 and 2:

Document 1: JP11-117061

Document 2: JP9-074097

2) The claims have been amended as follows. Claims 1 to 3 have been amended. Incidentally, this amendment does not introduce any new matter or change the gist of the invention. Further, in addition to the inappropriate description being corrected, as described later, Applicant believes that the present invention possesses novelty and inventive step.

(Claims)

[1] (Amended) A nickel alloy sputtering target for forming a film for preventing Sn diffusion comprising 1 to 30at% of Cu; 2 to 25at% of at least one element selected from among V, Cr, Al, Si and Mo; remnant Ni and unavoidable impurities.

[2] (Amended) The nickel alloy sputtering target according to claim 1, wherein the

nickel alloy is formed by adding at least one element selected from among V, Cr, Al, Si and Mo to Ni-Cu solid solution.

[3] (Amended) The nickel alloy sputtering target according to claim 1 or claim 2 further comprising Ti, wherein the total amount together with at least one element selected from among V, Cr, Al, Si and Mo is 2 to 25at%.

[4] A nickel alloy thin film formed between a solder bump and a substrate layer or a pad, and comprising 1 to 30at% of Cu; 2 to 25at% of at least one element selected from among V, Cr, Al, Si, Ti and Mo; remnant Ni and unavoidable impurities.

[5] The nickel alloy thin film formed between a solder bump and a substrate layer or a pad according to claim 4, wherein the nickel alloy is formed by adding at least one element selected from among V, Cr, Al, Si, Ti and Mo to Ni-Cu solid solution.

[6] The nickel alloy thin film formed between a solder bump and a substrate layer or a pad according to claim 4 or claim 5, wherein the solder bump is a Pb-free Sn solder or a Sn solder.

[7] The nickel alloy thin film according to any one of claims 4 to 6, further comprising a Cu-Sn intermetallic compound layer between a solder bump and a substrate layer or a pad.

[8] The nickel alloy thin film according to claim 7, further comprising a 0.01 to 5 μ m Cu-Sn intermetallic compound layer between a solder bump and a substrate layer or a pad.

3) Next, the present invention and the Cited Documents are compared.

Document 1 (JP11-117061) describes a "black matrix target where Cu is 0.5 to 60wt%, Ti is 0.1 to 25wt%, and the remnant is Ni". Ti was included as the selective component in claims 1 and 2 of the present application before amendment. When Ti exists, this would become the same component when viewing the constituent of the target. Thus, Ti has been deleted from the wording of claim 1 of the present application.

In order to substantially inhibit the diffusion of Sn between a solder bump and a substrate layer or a pad, the present invention relates to a nickel alloy sputtering target for forming a film therebetween capable of preventing such diffusion.

As evident from the above, the present invention is related to entirely different technology in comparison to Document 1 which describes a target for forming a thin film used in forming a black matrix. In order to clarify this point further, the wording of "for forming a film for preventing Sn diffusion" has been added to claim 1. Thereby, Applicant is of the opinion that the technical difference with Document 1 has

become clearer.

4) As described above, the present invention and Document 1 relate to entirely different technologies. With claim 3 of the present application, in addition to the selective components, a configuration has been added where Ti is further contained within a range of 2 to 25at%. Since this is not an independent addition, it is clearly different from Document 1.

Further, since the foregoing wording is included in the original Description, this does not constitute new matter or change the gist of the invention.

5) Document 2 (JP9-074097) has a conflicting description which is barrier metal based on at least one type of material selected from among Cu, Ni, Ti, W, Ag and Mo, but contains at least one type of impurity selected from among Sn, Ti, Mg, Si, Pt, Pd, Sc, Cr, Ta and Cu (it is unclear as to whether Cu and Ti are primary components or impurities), and it is not possible to accurately understand the invention.

Further, with respect to Document 2 (JP9-074097), the Examiner is not indicating the difference in comparison to the present invention. Therefore, we are of the opinion that Document 2 cannot be used as grounds for denying the present invention.

As the Examiner mentioned that claims 4 to 8 possess novelty and inventive step, the detailed explanation thereof is omitted.

6) Accordingly, Applicant believes that the invention of this PCT application could not have been easily devised based on the technology described in the foregoing Documents 1 and 2. Further, we believe that the amendments clarified the present invention, and the difference with the Cited Documents has also become evident. Thus, we believe that the present invention clearly possesses inventive step.